

BEFORE THE
Federal Communications Commission
WASHINGTON, D.C. 20554

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**ORIGINAL
FILE**

In the Matter of)

)
)
) Amendment of Section 2.106 of
) the Commission's Rules to
) Allocate the 1610-1626.5 MHz
) and the 2483.5-2500 MHz Bands
) for Use By The Mobile-Satellite
) Service, Including Non-
) Geostationary Satellites)

ET Docket No. 92-28
RM-7771 PP-29 PP-32
RM-7773 PP-30 PP-33
RM-7805 PP-31
RM-7806

To: The Commission

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

COMMENTS OF TRW INC.

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SUMMARY

TRW Inc. ("TRW") strongly supports the Commission's proposed allocation of the 1610-1626.5 MHz and 2483.5-2500 MHz frequency bands (the "RDSS bands") to the mobile satellite service ("MSS"). Adoption of this proposal will implement the decisions made at the 1992 World Administrative Radio Conference ("WARC-92"), and pave the way for the launch of pro-competitive low-Earth orbit ("LEO") satellite systems. Systems such as TRW's Odyssey system will offer a wide range of new, low-cost voice, facsimile, and data messaging services on an international basis.

TRW believes that the record already established in this and related proceedings has shown that the spread spectrum modulation techniques proposed by TRW and several other applicants for non-geostationary MSS systems will provide the optimal competitive use of the RDSS bands. These competitive benefits cannot be provided by other proposed users of the spectrum, such as Motorola Satellite Communications, Inc. (which proposes a complex hybrid TDMA/FDMA bi-directional LEO MSS system) and American Mobile Satellite Corporation (which proposes expansion of its planned geostationary MSS system). Neither of these systems would promote the entry of multiple service providers, and neither would be likely to offer low-cost service.

Moreover, from a practical political standpoint, it is inevitable that other countries will wish to implement their own competing global LEO MSS systems. Commission approval of a system that precludes future entry likely would be viewed as preemptive and confrontational by other nations, a reaction that

this country can ill-afford to provoke in view of current trade tensions, and one that is inimical to the national goal of promoting new U.S. technology overseas.

For these reasons, the Commission should move expeditiously to adopt the international standards approved at WARC-92, including the relaxed limits applicable to equivalent isotropically radiated power and power flux density. The Commission should also take steps to ensure that adequate feeder link spectrum will be available for LEO MSS operations by making clear that non-geostationary systems sharing the fixed-satellite service ("FSS") spectrum for feeder link operations will simply be required to coordinate with any geostationary FSS systems that may ultimately be authorized, without the latter being given priority.

With respect to possible radiofrequency ("RF") radiation danger from LEO MSS handsets, TRW notes that its Odyssey system will utilize hand-held transceivers that radiate at approximately 0.5 Watts, less than current terrestrial cellular telephones, which typically radiate at between 0.6 and 1.2 Watts. Odyssey's digital signals also will have electromagnetic characteristics substantially similar to analog signals, resulting in no greater RF danger to users.

Finally, TRW believes that the Commission's tentative decision denying it a pioneer's preference for the Odyssey system was incorrect. However, TRW also believes that the Commission has pursued a prudent path in declining to award any preference in this proceeding; therefore, this decision should be finalized.

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To: The Commission

COMMENTS OF TRW INC.

TRW Inc. ("TRW"), by its attorneys and pursuant to Section 1.415 of the Commission's rules, hereby comments on the Commission's Notice of Proposed Rule Making and Tentative Decision in the above-captioned docket, 7 FCC Rcd 6414 (1992) ("Notice"). In the Notice, the Commission proposes to allocate the 1610-1626.5 MHz and 2483.5-2500 MHz bands, currently allocated to the radio-determination satellite service ("RDSS"), to the mobile-satellite service ("MSS"), for use, inter alia, by systems utilizing low-Earth orbit ("LEO") and other non-geostationary satellites. This proposal mirrors the allocation decisions made earlier this year at the World Administrative Radio Conference ("WARC-92") and, as noted by the Commission, will pave the way for systems offering "a wide range of new and low-cost services, with a potentially world-wide scope, such as voice, facsimile and data messaging, and fleet surveillance and

control." Notice, 7 FCC Rcd at 6414. TRW strongly supports the proposed domestic allocation, which implements the U.S. proposal that gained international acceptance at WARC-92, and urges its complete and expeditious approval.

I. INTRODUCTION

In 1985, the Commission determined that the public interest warranted an allocation of spectrum for the provision of RDSS, and allotted the 1610-1626.5 MHz and 2483.5-2500 MHz bands for this purpose. See Amendment of the Commission's Rules to Allocate Spectrum for, and to Establish Other Rules and Policies Pertaining to, a Radiodetermination Satellite Service, 58 R.R.2d 1416 (1985). One of the paramount policy objectives underlying that decision, and the Commission's 1986 decision adopting technical rules and granting initial RDSS authorizations, was the Commission's goal of promoting competition in the delivery of satellite services by facilitating multiple entry. See Amendment to the Commission's Rules to Allocate Spectrum for, and to Establish Other Rules and Policies Pertaining to, a Radiodetermination Satellite Service, 104 F.C.C.2d 650, 653-654 (1986) ("RDSS Licensing Order"). This pro-competitive stance is not unique to RDSS, but has been an integral part of the Commission's approach to the establishment of new satellite services since the early 1970s. See, e.g., Establishment of Satellite Systems Providing International Communications, 101

F.C.C.2d 1046, 1065 (1985) ("Separate Systems Order") (Commission summarizes history of pro-competitive initiatives in satellite decisions). See also Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum to the Fixed-Satellite Service and the Mobile-Satellite Service for Low-Earth Orbit Satellites, 6 FCC Rcd 5932, 5935 (1991) (Commission proposes to establish low-Earth orbit satellite service; states intention "to provide for multiple operators of LEO systems").

To ensure that the public would reap the benefits of competition, the service rules adopted by the Commission in its RDSS Licensing Order required applicants to use spectrum sharing techniques that would permit multiple service providers to coexist in the same frequency bands. See RDSS Licensing Order, 104 F.C.C.2d at 661-62; 47 C.F.R. § 25.141. Indeed, the Commission made clear that only in the most extraordinary circumstance -- specifically, a case where the design of a system requiring exclusive access to the bands was proven to be "unquestionably superior" to the design(s) of systems that permitted multiple entry -- would it authorize a service provider that proposed exclusive use of the RDSS bands. RDSS Licensing Order, 104 F.C.C.2d at 660.

These fundamental and longstanding policies are promoted by the majority of the applicants (including TRW) whose proposals for the L-band and S-band frequencies originally allocated for RDSS are reflected in the Notice. Five applicants

-- TRW, Constellation Communications, Inc. ("Constellation"), Ellipsat Corporation ("Ellipsat"), Loral Qualcomm Satellite Services, Inc. ("LQSS"), and Motorola Satellite Communications, Inc. ("Motorola") -- have requested rule changes that would permit construction of global, non-geostationary MSS systems in the RDSS bands to provide voice and data services in addition to RDSS. Four of these five applicants -- that is, all save Motorola -- propose systems that are consistent with the primary MSS allocations that were made at WARC-92 and with the existing RDSS rules pertaining to competitive entry. Through their proposals to use spread spectrum code division multiple access ("CDMA") modulation techniques, these parties will maximize spectrum sharing, thereby ensuring that the public will have the benefit of access to competing service providers. Indeed, the four spread spectrum applicants agree that their systems will not only be capable of sharing the 1610-1626.5 MHz and 2483.5-2500 MHz bands with each other, but also will be able to share with additional similar systems -- whether such systems are to be licensed by the Commission in the future or by other governments.

The Motorola proposal, dubbed "Iridium," would use a large portion of the L-band RDSS allocation, where it proposes to operate Earth-to-space links, and also to employ the secondary allocation in that same band for space-to-Earth links. The Iridium system would utilize a hybrid of Frequency Division Multiple Access ("FDMA") and Time Division Multiple Access

("TDMA") modulation techniques. Such a system as currently designed is incapable of sharing the utilized frequencies with the unidirectional spread spectrum systems (or with any other system), and thus would monopolize the band, both domestically and globally.

The sixth applicant -- American Mobile Satellite Corporation ("AMSC") -- proposes a geostationary MSS system in the 1616.5-1626.5 L-band RDSS segment. As a result of actions taken at WARC-92, however, AMSC's RDSS-band proposal is currently without a companion allocation for downlink operations. See Notice, 7 FCC Rcd at 6416 & n.15. Nevertheless, AMSC has maintained its request that the Commission permanently assign these frequencies to it -- for its exclusive use -- so that it can expand its long-planned (and still non-operational) MSS system. See AMSC Petition for Rule Making, RM-7806 (filed June 3, 1991); Comments of TRW Inc., RM-7806 (filed October 16, 1991) at 9-10. In addition to the loss of its proposed downlink band, however, it appears that AMSC's proposed use of the 1616.5-1626.5 MHz band will not comply with the power limits imposed on this band at WARC-92.^{1/}

^{1/} A seventh rulemaking proposal, advanced by CELSAT, Inc., suggested the RDSS frequencies as an allocation option for a hybrid space/terrestrial personal communications service. However, because the terrestrial component of this plan would not conform to the international allocations adopted at WARC-92, the Commission properly dismissed the portion of CELSAT's request pertaining to the RDSS bands. Notice, 7 FCC Rcd at 6416 n.15.

The conflict between the Motorola and AMSC monopoly proposals on the one hand, and the pro-competitive proposals of TRW and the other spread spectrum systems on the other, is thus clearly delineated. By implementing the WARC-92 allocations as adopted, the Commission will be taking a step that brings the U.S. proposals advanced at WARC-92 to a successful culmination domestically, and will be doing so in a manner that is fully consistent with its longstanding policies favoring competitive multiple entry. TRW, therefore, supports the allocation proposed in the Notice.

In its Notice, the Commission posed a number of questions relating to the foregoing conflict, requesting input in particular on the potential for the different access schemes to support multiple licensees and promote competition and other benefits to consumers. The Commission also focussed on several ancillary questions and potential difficulties affecting utilization of the RDSS bands for MSS, including whether the equivalent isotropically radiated power ("EIRP") and power flux density ("PFD") limits and associated coordination procedures adopted at WARC-92 should be adopted domestically; whether adequate feeder link spectrum will be available to support multiple MSS systems; whether MSS use of the RDSS L-band spectrum might result in harmful interference to existing and proposed radioastronomy and aeronautical radionavigation uses; and whether the hand-held receive/transmit devices that would be used with

most of the proposed systems would comply with current industry guidelines with respect to radiofrequency ("RF") radiation.^{2/}

TRW believes that the record thus far established in this proceeding in response to the various parties' petitions for rule making has already demonstrated that spread spectrum CDMA techniques will provide the optimal competitive environment for LEO MSS service. A market of sufficient size exists to support several competing service providers. At present, however, it is unlikely that either the complicated bi-directional proposal put forth by Motorola or AMSC's geostationary system can co-exist with other providers, and neither can offer the pro-competitive, low-cost service that will be offered by TRW's Odyssey system and other spread spectrum systems. Only the spread spectrum systems are capable of complying with the Commission's RDSS rules and with the recently adopted international limits relating to EIRP density, while providing service to hand-held terminals consistent with the safety standards for human exposure to RF radiation. Moreover, unlike Iridium's bi-directional system, the threat of harmful interference posed by these systems to other users of L-band spectrum is readily resolvable. Finally, with

^{2/} The Notice also implicitly raises the question whether the Commission acted correctly in deciding that none of the parties to this proceeding is entitled to a pioneer's preference under the standards established by the Commission. As discussed below, while TRW believes that the Commission was incorrect in failing to recognize TRW's pioneering contributions, it believes that the Commission's decision was both reasonable and prudent in light of all of the circumstances.

appropriate Commission clarifications, there should be sufficient Ka-band spectrum to provide adequate feeder links for LEO MSS providers.

II. SPREAD SPECTRUM MODULATION PROVIDES THE BEST MEANS OF PROMOTING COMPETITION IN THE MSS LEO SERVICE.

In its Notice, the Commission tentatively concluded that "the public interest is best served by multiple MSS LEO operators." Notice, 7 FCC Rcd at 6417. TRW wholeheartedly endorses this tentative conclusion. In response to what is perhaps the most significant question posed by the Commission in the Notice -- i.e., which of the proposed access methods has the most promising potential to support service by multiple LEO licensees -- TRW states that the extensive record established thus far in the instant proceeding clearly shows that CDMA spread spectrum modulation techniques provide the best means of ensuring competition among multiple providers, and that the expected demand for the MSS services to be provided by the applicants will be large enough to support multiple entrants. By contrast, the systems proposed by Motorola and AMSC, in their current incarnations, are completely incapable of sharing the frequency bands each seeks.

**A. The Market Potential For MSS Systems In The
1610-1626.5 MHz And 2483.5-2500 MHz Frequency
Bands Is Enormous.**

Although the Commission claims to have very little information on the volume of traffic the LEO MSS systems propose to carry (see Notice, 7 FCC Rcd at 6416), there is no doubt that wide, untapped demand exists for satellite systems providing ubiquitous global telecommunications services to hand-held units. All of the applicants seeking to use the RDSS frequencies agree that there is broad market potential, both domestically and internationally, for new MSS systems providing such services. TRW estimates that Odyssey will have in excess of 2 million users and that its system will be economically viable with as little as a third of the anticipated market. Other estimates of total potential LEO MSS subscriber demand range from 2.1 million to 5.2 million users shortly after the turn of the century. See Presentation by LQSS to Commission on European Communities (Nov. 9-10, 1992). See also "Special Report -- Smallsat Systems Are Chasing Real Markets, Satellite News, October 26, 1992, at 7; Constellation Application at 11 and Appendix D. Although actual demand will depend in substantial part on the cost of service, there can be little doubt that the market will be sufficiently large to support multiple service providers, as originally envisioned. See "New Study: Voice Market Will Be Tough To Reach From GEO," Satellite News, November 2, 1992, at 6, attached hereto.

B. Of The Several Types Of Access Schemes Proposed, Code Division/Spread Spectrum Sharing Is The Best Method Of Ensuring Multiple Entry.

In view of the anticipated demand for these services world-wide and the inherent global scope of LEO MSS systems, it is axiomatic that only systems that can share spectrum with other international providers will be both technologically and politically viable. Systems employing spread spectrum access techniques are inherently flexible in their ability to allow multiple access by different systems in the same spectrum. Each of the currently proposed CDMA systems is designed to operate in the presence of both self-interference and interference caused by the other spread spectrum systems.

1. Spread Spectrum Modulation Is Uniquely Well Suited To Providing Maximum Spectrum-Efficient Use In A Multiple Operator Environment.

Spread spectrum systems spread each voice channel across a much wider bandwidth than that required to carry the information present. By suitable frequency hopping or signal spreading codes, it is possible to overlay several such signals on top of each other. Each receiver receives its intended signal and "sees" the other overlayed signals as if they were noise-like interference. In the case of CDMA, each link is designed to cope with this "self-interference" of the other signals in the same way as if it were interference caused by other similar systems.

Indeed, it is the inability of systems to distinguish between intra-system and inter-system interference that makes these systems inherently better suited to the multiple operator environment.

The ability of spread spectrum systems to cope with intersystem and intrasystem interference is achieved by building an extra margin into the link budgets. The extra margin required to overcome interference (typically less than 1 dB) is quite small in comparison to the link margins that would be required to overcome propagation effects, such as attenuation, blockage, and multipath, that will be experienced by MSS systems operating at low satellite elevation angles.^{3/} Thus, these systems are much more flexible in terms of interference tolerance and ability to adapt to future entrants. In addition, because spread spectrum systems are able to cope with varying amounts of interference, it is possible to implement system designs that permit much greater frequency re-use by means of spatial isolation. For these reasons, it is possible for the Commission to authorize all of the current applicants that propose to employ spread spectrum modulation in the 1610-1626.5 MHz and 2483.5-2500 MHz bands, and regulate them only to the extent necessary to assure that the systems are coordinated to avoid interference. Authorized

^{3/} TRW's Odyssey system, which operates in medium Earth orbit, uses higher elevation angles than most of the currently-proposed non-geostationary MSS systems.

systems will thus have an incentive to coordinate, and potential future entrants (whether domestic or foreign) will not be foreclosed by unduly rigid spectrum restrictions or arbitrary band segmentation plans.

2. **The Multiple Entry Features Of Spread Spectrum Modulation Will Facilitate Global Acceptance Of The U.S. LEO MSS Systems.**

Insofar as future entry is concerned, it is to be expected that much of the initial demand for LEO MSS services will emanate from the United States. Nevertheless, it is likely that other countries will wish to implement their own world-wide LEO MSS systems. The International Maritime Satellite Organization ("INMARSAT") recently announced plans to proceed with a LEO MSS system, and others are bound to follow. Under such circumstances, adoption of a U.S. allocation that precludes entry by additional service providers likely would be viewed as preemptive and confrontational by other nations. Indeed, members of the European Community ("EC") have already expressed concerns in this regard. See "U.S. Accepts EC Commission Request for Informal Talks on Policy, Market Issues Related to Big, Little LEO Proposals, WARC Allocations," Telecommunications Reports, July 27, 1992, at 15.

Recent international trade tensions suggest that failure to heed the concerns of the EC and other players on the international front could have a substantial negative impact on

attempts to promote U.S. technology abroad. Conversely, selection of the service standards proposed by the non-geostationary MSS systems that are capable of sharing spectrum with both currently proposed and future competitors will promote U.S. technology without provoking political controversy.

C. Secondary, Bi-Directional Use Of The 1616-1626.5 MHz Band, Even If Eventually Shown To Be Feasible, Is Inconsistent With Use By Multiple Operators.

In the wake of WARC-92, the portion of the 1610-1626.5 MHz band requested by Motorola for bi-directional operation may indeed be used for space-to-Earth links. However, the allocation is only secondary. Notice, 7 FCC Rcd at 6418.^{4/} For this reason, such a system would always be vulnerable to interference from other MSS systems that ultimately might operate on a primary basis in this band elsewhere in the world -- as well as to

^{4/} Prior to the actions taken at WARC-92, this band was allocated for aeronautical radionavigation and RDSS earth-to-space links on a co-primary basis. At WARC-92, MSS Earth-to-space links were added to the co-primary allocation and MSS space-to-Earth links were added as a secondary allocation. See International Telecommunication Union, Addendum and Corrigendum to the Final Acts of the World Administrative Radio Conference (WARC-92) at 11 (Malaga-Torremolinos, 1992). ("Addendum and Corrigendum to Final Acts (WARC-92)"). Under international and FCC rules, stations operating pursuant to a secondary allocation may not "cause harmful interference to stations of primary or permitted services to which frequencies are already assigned or to which frequencies may be assigned at a later date," nor may these secondary stations claim any protection from such primary stations. 47 C.F.R. § 2.104(d)(4).

demands for interference protection -- regardless of what the FCC does domestically.

In its Notice, the Commission directly questioned the feasibility of bi-directional use of the 1610-1626.5 MHz band. Notice, 7 FCC Rcd at 6418. Indeed, Motorola has not demonstrated that it can avoid destructive self-interference from bi-directional operation in the 1616-1626.5 MHz bands, let alone interference to and from other systems. The viability of its bi-directional TDMA/FDMA scheme depends on the theoretical ability to achieve near-perfect timing synchronization between transmit and receive modes, and on the virtual absence of interference or other uses of the band anywhere in the world. Achievement of such synchronization is made doubtful by technical obstacles such as specular reflection from the Earth's surface, and other causes. For these reasons, Iridium would likely require substantial "guard bands" to avoid mis-timing, a solution that would reduce spectrum efficiency to a much lower figure than claimed by Motorola.

Even if Motorola's planned in-orbit "frequency brinksmanship" can successfully avoid potential interference from its own transmissions, its Iridium system still would require an exclusive worldwide frequency allocation to avoid causing destructive interference to, and receiving interference from, other systems. In view of the unparalleled complexity of the Iridium system, inter-system synchronization between two bi-

directional systems would be virtually impossible. This fact, combined with the technical inability of even two Iridium-like systems to operate simultaneously in the same geographic region and spectrum, and the inherent global nature of LEO MSS systems, means that even domestic segmentation of these frequencies would result in a de facto global monopoly.^{5/}

Because of these limitations, authorizing an Iridium-type system to operate in the secondary MSS allocation would be a waste of spectrum, and would likely lead to the exclusion of all U.S. companies from the RDSS-band MSS market. The inevitable advent of foreign MSS systems that would use the primary MSS allocation would eventually preclude a system such as Iridium from continued operation in the L-Band outside of the U.S.

In short, Motorola's secondary proposal is completely antithetical to the Commission's conclusion to establish multiple LEO MSS systems in the former RDSS bands. Not only is the feasibility of the technology suspect, the inability of Motorola

^{5/} With a system such as Iridium -- i.e., a system designed to require worldwide exclusive access to spectrum -- the only way to share the available spectrum is to subdivide the band into smaller pieces, and to dedicate each piece to a single operator. Unfortunately, even a band segmentation approach will be totally unworkable in the case of Motorola's bi-directional system. The large numbers and unprecedented complexity of the satellites in the Iridium system will lead to a very high system cost (which is currently severely underestimated by Motorola). This means that the Iridium system has a very high break-even point and would, at a minimum, require the use of almost the entire available uplink spectrum in the 1610-1626.5 MHz band throughout the entire world to serve a number of users required for economic survival.

to share the spectrum it would use with any other domestic or foreign system -- regardless of design -- renders it incapable of receiving authorization in today's pro-competitive and political environment.^{6/}

D. Geostationary MSS System Designs, Such As That Proposed By AMSC, Are Incompatible With LEO MSS Spectrum Sharing And With The WARC-92 L-Band Allocation.

In its Notice, the Commission rejected a substantial part of AMSC's spectrum allocation proposal. The Commission noted that AMSC's proposed frequency complement for the 1616.5-1626.5 MHz band (the 1515-1525 MHz band) is not usable for MSS as a result of actions taken at WARC-92. Notice, 7 FCC Rcd at 6416 n.15. Moreover, even though the 1616.5-1626.5 MHz band was proposed for MSS, the uplink EIRP density values adopted in international Radio Regulation Footnote 731X (and proposed for

^{6/} TRW notes, however, that although the spread spectrum systems proposed for the LEO MSS service cannot be modified to share spectrum with the TDMA/FDMA system currently proposed by Motorola, it may be possible for Motorola to modify the Iridium design to permit sharing with the spread spectrum systems without abandoning the TDMA/FDMA techniques upon which it is based. First, Motorola could abandon bi-directional use of the L-band frequencies, and use other spectrum for downlinks, as was anticipated at WARC-92. Second, Motorola could incorporate extra margin in the Iridium links to compensate for interference from other systems, as the CDMA systems already propose to do. The Commission should require Motorola to show whether it can make either or both of these adjustments and still establish a viable system.

adoption in the Notice) effectively preclude AMSC's geostationary non-spread spectrum MSS system from using the band.^{1/}

AMSC, in contrast with the other applicants and proponents, does not propose a system that would be limited to the current RDSS bands. Instead, AMSC proposes to use the MSS allocation to expand its proposed upper L-Band MSS system. Like Motorola, AMSC's currently-proposed system is completely incompatible with all of the other proposed systems. In other words, AMSC proposes a monopoly system. Unlike Motorola, however, AMSC's MSS monopoly (though limited to the United States) would extend beyond the RDSS bands, and into other frequencies to which it has already been granted exclusive access by the Commission.

In addition, because of the need for greater satellite size and power from higher orbits, geostationary systems such as the one proposed by AMSC have difficulty in offering the types of service that the Commission envisions as a result of this proceeding, including global "cellular-like" (i.e., hand-held) telephone service. Notice, 7 FCC Rcd at 6416. Attempts to utilize geostationary satellites to provide this type of service are likely to be technically difficult, if not prohibitively

^{1/} See Consolidated Response of TRW Inc., File Nos. 15-DSS-MP-91 and 16-DSS-MP-91 (filed March 27, 1992), at 24-25.

expensive.^{8/} Not only will the time delay inherent in transmitting to and from geo-stationary satellites be likely to produce objectionable echoes, the power required to transmit such signals may prove dangerous to users. See infra at Section III.D.

In sum, it would be wasteful indeed to disadvantage the pro-competitive spread spectrum systems in order to authorize a monopoly system whose base license is still under challenge and that still faces serious international coordination obstacles. Thus, sound policy and reasoned decision making require rejection, or at least modification, of the non-spread spectrum systems proposed by Motorola and AMSC.

E. The Commission Must, As A Matter of Policy, Make The Allocation That Permits Sharing And Multiple Entry.

In its Notice, the Commission made clear its conclusion that the public interest will be best served by a service that is provided by multiple MSS LEO operators. Notice, 7 FCC Rcd at 6417. Indeed, the Commission has often expounded on the marketplace benefits of multiple competitors. For example, in establishing international separate satellite systems, the Commission described the salutary effects as follows:

^{8/} See "New Study: Voice Market Will Be Tough To Reach From GEO," Satellite News, November 2, 1992, at 6, attached hereto.

The hallmark of a competitive market is the maximization of customer choice which can be effectuated by allowing multiple entrants (i.e., adopting an open entry policy with little or no entry barriers). With the power of choice, customers are better able to influence the types of services available simply by frequenting one service provider over another. This market pressure not only encourages service providers to be responsive to customer needs, but also encourages them to lower the price of their services in order to obtain a larger share of the market and, therefore, to maximize profits and to offer service in the most efficient and economical manner. The end result of this process is reduced rates and service more responsive to customer needs.

Separate Systems Order, 101 F.C.C.2d at 1065 (footnote omitted).

Given the demonstrated superiority of CDMA spread spectrum techniques to achieve these important benefits, it would be contrary to current Commission objectives in this proceeding, as well as the longstanding national policy favoring competition in delivery of satellite services, for the Commission to pursue a path leading to the establishment of a service monopoly. Only through competition can the Commission guarantee to the public the best possible array of services at the most reasonable prices. Only through multiple entry can these competitive benefits be achieved. And only through the use of CDMA spectrum sharing techniques can the feasibility of multiple competing service providers be assured. Thus, the proposals advanced by

AMSC and Motorola must be rejected, and rules expeditiously adopted to permit the implementation of the CDMA systems.

III. THE COMMISSION SHOULD PROMOTE RAPID DEVELOPMENT OF SPREAD SPECTRUM LEO MSS SYSTEMS BY EXPEDITIOUSLY RESOLVING THE REMAINING TECHNICAL ISSUES.

A. The Commission Should Adopt The EIRP Density And PFD Limits Agreed To At WARC-92.

In the Notice, the Commission proposed generally to require licensees operating in the current RDSS bands to comply with the PFD limits adopted at WARC-92. TRW originally requested a modest relaxation of the PFD limit contained in international Radio Regulation No. 2557, which was then applicable in the 2483.5-2500 MHz frequency bands. See TRW Inc. Petition for Rule Making and Request for Pioneer's Preference, RM-7773 (filed July 8, 1991), at 11-13. Now, however, TRW believes that the proposals adopted at WARC-92 should be a reasonable means for achieving more efficient use of these bands.

For the S-Band, the WARC-92 solution essentially couples a modest reduction in the "limit" itself with a change in the effect of the limit. First, instead of the limit contained in international Radio Regulation No. 2557, the less stringent value contained in Radio Regulation No. 2566 will now apply to the subject frequency bands. More significantly, the PFD limit